REMARKS

Claims 1-16 are pending herein. Claims 1, 3-5 and 7-9 have been amended hereby to correct matters of form and for clarification purposes only. Claim 2 has been rewritten in independent form for the reasons explained below. New claims 10-16, which depend directly or indirectly from independent claim 2, have been added hereby to recite the subject matter of multiple dependent claims that were amended when this application was originally filed. No new matter has been added.

1. Applicant appreciates the Examiner indicating that claim 2 would be allowed if rewritten in independent form. Claim 2 has been so rewritten above, and thus is in condition for allowance. In addition, Applicant respectfully submits that new claims 10-16, which depend either directly or indirectly from independent claim 2, are in condition for allowance, as well. Moreover, Applicant respectfully submits that all claims pending herein are in condition for allowance for the reasons explained below.

2. Claims 1 and 8 were rejected under §102(e)/§103(a) over Matsubara. Applicant respectfully traverses these grounds of rejection.

Independent claim 1 recites a corrosion-resistive member having a corrosion-resistive face which is exposed to a corrosive gas causing ion bombardment. At least a part of the corrosion-resistive member comprises a sintered silicon nitride body having an open porosity of not more than 5%, and the sintered silicon nitride body constitutes the corrosion-resistive face. The corrosion resistive-member recited in claim 1 is further characterized in that if two auxiliary planes are formed by cutting the corrosion-resistive member to intersect vertically with the corrosion-resistive face and to be located vertically with respect to each other, an orientation index between the two auxiliary planes is in a range of 0.8 to 1.2, and an orientation index between the corrosion-resistive face and each of the auxiliary faces is not less than 1.5. The orientation indices are calculated using the detailed formulae recited in claim 1.

Dependent claim 8 recites that the corrosive gas to which the corrosion-resistive member recited in claim 1 is exposed is a halogen-based corrosive gas or a plasma of the halogen-based corrosive gas. The PTO did not give any patentable weight to the limitations

recited in claim 8, however, on the grounds that "a corrosive-gas is not a part of the structure of a corrosion-resistive member" and is "considered a product-by-process limitation" (Office Action, page 2, section 3, lines 5-6).

The present invention relates to a corrosion-resistive member for use in a semiconductor producing apparatus, for example. The corrosion-resistive member according to the present invention may be used as a substrate for a susceptor upon which a semiconductor wafer is placed, such as a ceramic electrostatic chuck, a ceramic heater and a high frequency electrode, for example. "In addition, the corrosion-resistive members according to the present invention may be used as a substrate for various semiconductor-producing apparatuses, including rings such as shadow rings, chamber liners, gas shower plates, nozzles, dummy wafers, lift pins for supporting semiconductor wafers, shower plates, etc." (Specification, paragraph [0040], page 9, lines 2-9).

Applicant first discovered that superior corrosion resistance, particularly to halogen based corrosive gases typically used in semi-conductor producing environments, is achieved by utilizing the specifically claimed crystal orientation which affords anisotropy to the sintered body. Applicant respectfully submits that the orientation indices recited in claim 1 are a physical characteristic of the claimed corrosion-resistive member, and that the language describing these indices is not product-by-process language, as asserted in the Office Action. Instead, this language describes how the crystal orientation is defined, not obtained.

Applicant's discovery that the claimed orientation indices provide superior corrosion resistance is a significant advance in this particular field. The orientation indices are the result of selecting compositional components and processing parameters, examples of which are disclosed in the present specification. For example, the processing parameters associated with producing the claimed corrosion-resistive member include hot pressing a carbon-covered formed body in a carbon mold at, for example, 1800 °C in N_2 at 2 atm, and holding for 6 hours at a pressure of 20 MPa (see specification, page 9, paragraph [0043]). This is but one exemplary process step by which the claimed orientation indices are created.

Applicant respectfully submits that Matsubara is silent with respect to the claimed ori ntation indices, and more importantly, the superior corrosion resistance attributable to the claimed orientation indices. Applicant respectfully submits that the beneficial characteristics,

i.e., high density, high hardness, excellent wear (physical, not chemical) resistance and chipping resistance of Matsubara's silicon nitride cutting insert are attributed to the oxygen content of the sintered body, not due to any particular crystal orientation of the planes of Matsubara's silicon nitride body. Indeed, the Matsubara reference itself discloses that the beneficial characteristics of the cutting insert are attributed to the fact that the oxygen content of the cutting insert sintered body is controlled to be in a range of 1.2-1.5 wt% (Matsubara, Col. 3, lines 59-63). Moreover, the wear resistance of Matsubara's silicon nitride body relates to the physical wear and degradation experienced by a cutting insert that is used to abrade or cut other materials, not to chemical corrosion resistance, which is supported by Fig. 2 of Matsubara and is discussed in more detail below.

There is no mention in Matsubara of corrosion resistance as it relates to crystal orientation indices, much less any recognition of the specific relationship between the claimed orientation indices and corrosion resistance first discovered by Applicant.

In the Office Action, the Examiner admitted that Matsubara was silent as to orientation indices, but asserted that the claimed orientation indices would be inherently present in Matsubara's silicon nitride body. Applicant respectfully submits, however, that the PTO has not proffered any evidence to support its assertion that Matsubara's silicon nitride body would inherently have the claimed orientation indices.

Moreover, Applicant respectfully submits that the PTO has improperly based its inherency argument on a false premise of compositional similarity. For example, the PTO asserted that "[I]t is the examiner's position that the article of Matsubara is identical to or only slightly different than the claimed article prepared by the method of the claim, because both articles are formed from the same materials, having structural similarity (a silicon nitride sintered body having excellent wear resistance and an open porosity of 0.02% by volume or less)" (Office Action, section 3, page 2, final two lines – page 3, line 3).

Applicant respectfully submits, however, that the "article of Matsubara," which is a cutting insert, is **not** "identical to" or even "only slightly different than" the corrosion-resistive member recited in claim 1. With respect to composition, Matsubara's silicon nitride sintered body requires a sintering aid, such as Al_2O_3, to promote densification and reduce, but not eliminate, the amount of glassy phase present in the grain boundary region of the sintered body. In Col. 5 of Matsubara, Table 1 shows that 1 wt. % Al_2O_3 was used as a sintering aid in

all seven samples. Applicant respectfully submits that one skilled in the art would realize that adding alumina, when processed at high temperatures as disclosed in Matsubara, would promote a glassy phase, not an ordered crystal structure, upon sintering. And, as mentioned above, it is the oxygen content of the sintered silicon nitride body, not any particular crystal orientation, that is desired for Matsubara's silicon nitride cutting insert.

Additionally, the processing parameters used to produce Matsubara's silicon nitride sintered body differ from those used to produce the corrosion-resistive member recited in claim 1. Applicant respectfully submits that Matsubara's processing steps would not promote anisotropy on a desired portion of the sintered cutting insert, and thus, the structure of Matsubara's cutting insert cannot be considered "identical to" or even only "slightly different" from the claimed corrosion-resistive member.

While Matsubara's sintered silicon nitride cutting inserts have "dense texture, high hardness, high fracture toughness, and high wear resistance" (Matsubara, Col. 3, lines 47-49), Applicant submits that the term "wear resistance," in the context of Matsubara, actually relates to cutting performance, that is, physical wear experienced during performance as a cutting insert (as described in Col. 4, lines 30-35 of Matsubara in connection with Fig. 2), not to corrosion resistance from chemical attack, as in the case of the present invention. For example, Matsubara's sample Nos. 1-5 were deemed to have "sufficient wear resistance" when the cutting insert experienced a VBmax cutting depth of 0.52 mm or less (Col. 6, lines 49-56) and sample No. 7 was deemed to have poor wear resistance when the VBmax was as much as 0.94 mm (Col. 6 line 65 – Col. 7, line 5). Again, there is no mention of chemical resistance in Matsubara.

As mentioned above, it is the processing considerations, in connection with the compositional considerations of the present invention, that yield the claimed crystal orientation states and the associated corrosion-resistive properties of the corrosion-resistive member recited in claim 1. In view of the differences in Matsubara's composition and the processing parameters discussed above, Applicant respectfully submits that skilled artisans would not *necessarily expect* (which is the required standard for inherency-based rejections) Matsubara's silicon nitride body to have the claimed orientation indices.

Perhaps more importantly, however, Applicant submits that Matsubara is completely silent with respect to Applicant's discovery that the claimed orientation indices provide

superior corrosion resistance. Matsubara does not recognize any relationship between these two features of the present invention, because these features are not even disclosed in Matsubara.

For at least the foregoing reasons, Applicant respectfully submits that claims 1 and 8 define patentable subject matter over Matsubara, and requests that the above rejection be reconsidered and withdrawn.

3. Claims 1 and 8 were rejected under §102(e)/§103(a) over Mehrotra et al. Applicant respectfully traverses this ground of rejection.

Independent claim 1 and dependent claim 8 are discussed above in section 2.

Mehrotra discloses a silicon nitride-based ceramic body, which, like Matsubara, is used as a metal cutting insert. The body has less than 0.2 volume percent porosity, and is formed by a green pressing step, a sintering step performed in 1 atm of N_2 at 1800-1850°C and then by hot isostatic pressing at 1750°C at 20,000 psi in N_2 to achieve densification (see Mehrotra, Col. 4, lines 34-42). In the Office Action, the Examiner admitted that Mehrotra was silent as to the claimed orientation indices, but asserted that the claimed orientation indices would be inherently present in Mehrotra's silicon nitride body.

For the same reasons detailed above, however, Applicant respectfully submits that the claimed orientation indices would not necessarily occur simply due to alleged similarities in composition and processing parameters. For example, in paragraph [0061] on page 16 of the specification, the Applicant states that "[e]ven if the hot press method is employed, the orientation degrees are not necessarily identical, and vary depending upon the kinds of the additives." That is, as described in section 2, above, it is the composition and the processing parameters that contribute to the crystal orientation and resultant corrosion resistance recited in claim 1.

Additionally, the processing parameters used to produce Mehrotra's silicon nitride sintered body differ from those used to produce the corrosion-resistive member recited in claim 1. Applicant respectfully submits that Mehrotra's processing steps would not promote anisotropy on a desired portion of the sintered cutting insert, and thus, the structure of Mehrotra's cutting insert cannot be considered "identical to" or even only "slightly different" from the claimed corrosion-resistive member.

Thus, based on the structural differences between the claimed corrosion-resistive member and Mehrotra's cutting insert, the compositional differences between the claimed invention and Mehrotra's silicon nitride body, and the different processing parameters under which the claimed corrosion-resistive member and Mehrotra's cutting insert are fabricated, Applicant respectfully submits that Mehrotra's silicon nitride body would not inherently have the claimed orientation indices.

Additionally, and as is the case with Matsubara, Applicant respectfully submits that there is no mention in Mehrotra of either corrosion resistance or crystal orientation indices, much less any recognition of the specific relationship between the claimed orientation indices and corrosion resistance first discovered by Applicant. Accordingly, Applicant respectfully submits that one skilled in the art could not possibly have arrived at the present invention in view of Mehrotra.

For at least the foregoing reasons, Applicant respectfully submits that claims 1 and 8 define patentable subject matter over Mehrotra. Accordingly, Applicant respectfully requests that the above rejection be reconsidered and withdrawn.

4. Claims 1 and 7-9 were rejected under §102(e)/§103(a) over Komatsu et al. Applicant respectfully traverses this ground of rejection.

Independent claim 1 is discussed above in section 2.

Dependent claim 7 recites that the corrosion-resistive member of claim 1 has a thermal conductivity of 50 W/m·K or less. Dependent claim 9 recites a semiconductor producing apparatus comprising a substrate which comprises the corrosion-resistive member of claim 1.

Applicant respectfully submits that while Komatsu relates to silicon nitride bodies for use in applications such as thyristors, which exhibits high corrosion resistance to metals (see Komatsu, Col. 2, line 8), and has a porosity of preferably 2.5 % or less, the thermal conductivity is preferably set to **at least 80 W/m·K** (Col. 4, line 33), and, for the same reasons explained above, the specific orientation indices recited in claim 1 do not inherently occur in Komatsu based simply on alleged compositional similarities.

Like the other applied references, Applicant respectfully submits that there is simply no disclosure in Komatsu of the claimed invention -- the discovery of the relationship between the specific orientation indices and the corrosion resistance attributable thereto.

Moreover, Applicant respectfully submits that Komatsu discloses a vast variety of sintering aids and specifically discloses that AlN can be used in connection with Al_2O_3 to assist the effectiveness of the rare earth sintering agent. Additionally, and contrary to the PTO's position, the processing parameters used to produce Komatsu's silicon nitride sintered body differ from those used to produce the corrosion-resistive member recited in claim 1. Komatsu specifically discloses that the processing parameters (cooling conditions in particular) are crucial to obtaining the desired characteristics of high density, good thermal conductivity and high mechanical strength. See for example, Komatsu, Col. 8, lines 16-16.

Komatsu particularly discloses that it is the cooling rate, rather than any particular crystal orientation, that plays a role with respect to the ratio, not orientation, of the crystal phase to glassy phase at the boundary region. For example, Col. 8, lines 27-38 recite that:

> "the rate of cooling a sintered body immediately upon completion of the sintering operation is an important control factor to achieve crystallization of the grain boundary phase. If the sintered body is rapidly cooled at a cooling rate higher than 100°C per hour, the grain boundary phase of the sintered body structure becomes an amorphous phase (a glass phase) and, therefore, the ratio of a crystal phase formed of the liquid phase to the entire grain boundary phase becomes less than 20%. Thereby, the strength and thermal conductivity of the sintered body are reduced to undesired levels."

In view of the foregoing, Applicant respectfully submits that Komatsu's silicon nitride body would not inherently have the claimed orientation indices.

Further, Applicant respectfully submits that there is no disclosure or suggestion in Komatsu that the silicon nitride body preferably has a thermal conductivity of 50 W/m·K or less, as recited in claim 7. Applicant respectfully submits that, while example 48 in Komatsu appears to show a thermal conductivity of 10 W/m·K, this low thermal conductivity is clearly not suitable for Komatsu's device, and is most likely a typographical error. That is, Examples 7-9 in Komatsu's Table 2 (bridging Cols. 13 and 14) include a 10 wt% addition of Ho_2O_3, and exhibit thermal conductivities of 95, 99, and 104 W/m·K, respectively. Example 48 in Table 3, however, includes a 10 wt% additive substitution for Ho_2O_3 represented by 6.5 Pr_8O_{11} and 3.5 Y_2O_3, but only had a thermal conductivity of 10 W/m·K. This is inconsistent with the paragraph following Table 3, which recites "as is apparent from the results shown in Table 3, the sintered bodies according to Examples 18-48 employing other rare earth elements instead

of Ho_2O_3 achieved generally the same functions as those of the sintered bodies employing Ho_2O_3" (Komatsu. Col. 15, lines 37-41). One skilled in the art would readily realize that when compared to thermal conductivities of 95, 99 and 104 W/m·K, a thermal conductivity of 10 W/m·K does not achieve "generally the same function." Accordingly, Applicant respectfully submits that the thermal conductivity recited in Table 3 for example 48 is clearly a typographical error and should be disregarded.

Moreover, Applicant respectfully submits that Komatsu is completely silent with respect to crystal orientation and does not recognize the specific relationship between crystal orientation and corrosion resistance first discovered by Applicant. Accordingly, Applicant respectfully submits that one skilled in the art could not possibly have arrived at the present invention in view of Komatsu.

For at least the foregoing reasons, Applicant respectfully submits that claims 1 and 7-9 define patentable subject matter over Komatsu. Accordingly, Applicant respectfully requests that the above rejection be reconsidered and withdrawn.

5. Claims 3-6 were rejected under§103(a) over Matsubara in view of Yamada et al., separately over Mehrotra et al. in view of Yamada et al., and separately over Komatsu et al. in view of Yamada et al. Applicant respectfully submits that Yamada et al. fails to overcome the deficiencies of the primary references as discussed above in detail. Accordingly, Applicant respectfully requests that the above rejections be reconsidered and withdrawn.

If the Examiner believes that contact with Applicant's attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicant's attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

July 22, 2003
Date

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